USDA Natural Resources Conservation Service

Ecological site R058BY122WY
Loamy (Ly) 10-14” PZ

Accessed: 07/09/2020

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

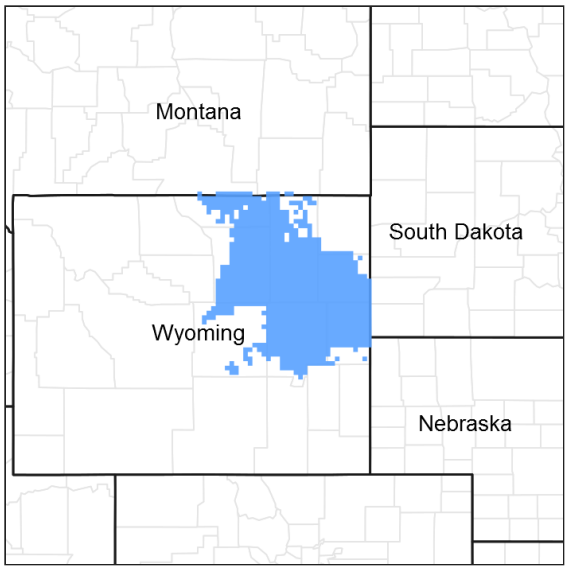

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 058B–Northern Rolling High Plains, Southern Part

MLRA 58B–Northern Rolling High Plains, Southern Part is located in northeastern Wyoming (95 percent) and extreme southeastern Montana (5 percent). It is comprised of sedimentary plains, scoria hills, and river valleys. The major rivers are the Powder, Tongue, Belle Fourche, Cheyenne, and North Platte. Other tributaries include the Little Powder River, Little Missouri River, Clear and Crazy Woman Creeks, and others. This MLRA is traversed by Interstates 25 and 90, and by U.S. Highways 14 and 16. The extent of MLRA 58B covers approximately 12.3 million acres. Major land uses include rangeland (approximately 93 percent), and cropland, pasture and hayland (approximately 2 percent), while forest, urban, and miscellaneous land occupy the remainder (approximately 5 percent). Cities include Buffalo, Casper, Sheridan, and Gillette, WY. Land ownership is mostly private. Federal lands include Thunder Basin National Grassland (U.S. Forest Service) and Bureau of Land Management properties. Areas of interest in MLRA 58B in Wyoming include Fort Phil Kearny State Historic Site, Glendo State Park, and Lake DeSmet.

The elevations in MLRA 58B increase gradually from north to south and range from approximately 2,900 to 5,900 feet. A few buttes are higher than 6,800 feet. The average annual precipitation in this area ranges from 10-17 inches per year. Precipitation occurs mostly during the growing season, often during rapidly developing thunderstorms. Mean

annual air temperature is 46°F. Summer temperatures may exceed 100°F. Winter temperatures may drop to subzero, and snowfall averages 45 inches per year, but varies from 25 to over 70 inches in some locales.

Classification relationships

USDA Natural Resources Conservation Service (NRCS):
Land Resource Region—G Western Great Plains Range and Irrigation; Major Land Resource Area (MLRA)—58B Northern Rolling High Plains, Southern Part (USDA, 2006)

Relationship to Other Classifications:

USDA Forest Service (FS) Classification Hierarchy:

Province—331 Great Plains-Palouse Dry Steppe; Section—331G-Powder River Basin; Subsections—331Gb Montana Shale Plains, 331Ge Powder River Basin, 331Gf South Powder River Basin-Scoria Hills (Cleland et al, 1997)

Environmental Protection Agency (EPA) Classification Hierarchy:

Level III Ecoregion—43 Northwestern Great Plains; Level IV Ecoregion—43p Scoria Hills, 43q Mesic-Dissected Plains, 43w Powder River Basin (EPA, 2013)
https://www.epa.gov/eco-research/ecoregions

REVISION NOTES:

The Loamy 10-14” PZ site was developed by an earlier version of the Loamy (Ly) 10-14” Precipitation Zone ESD (2001, updated 2005). The earlier version of the Loamy ESD were based on input from NRCS (formerly Soil Conservation Service) and historical information obtained from the Loamy 10-14 Northern Plains (NP) and Loamy 15-17 NP Range Site Descriptions (1988). This ESD meets the Provisional requirements of the National Ecological Site Handbook (NESH). This ESD will continue refinement towards an Approved status according to the NESH.

Ecological site concept

The Loamy 10-14” PZ site occurs on nearly level to gentle slopes on sedimentary plains or uplands. It is a cool-season dominant, mixed-grass prairie (short- and midgrasses); with a lesser component of forbs and shrubs.

Associated sites

R058BY104WY	**Clayey (Cy) 10-14” PZ**
R058BY128WY	**Lowland (LL) 10-14” PZ**
R058BY130WY	**Overflow (Ov) 10-14” PZ**
R058BY150WY	**Sandy (Sy) 10-14” PZ**
R058BY162WY	**Shallow Loamy (SwLy) 10-14” PZ**

Similar sites

R058BY222WY	**Loamy (Ly) 15-17” PZ** Loamy 15-17” PZ has higher production.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Artemisia tridentata* (2) *Krascheninnikovia lanata*
Herbaceous	(1) *Pascopyrum smithii* (2) *Hesperostipa comata*

Physiographic features

This site occurs on nearly level to gently sloping fans, ridges, and on footslopes or backslopes of hills, on sedimentary plains or uplands.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Fan remnant (3) Ridge (4) Hill
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	2,500–6,700 ft
Slope	0–15%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation ranges from 10 to 17 inches per year across MLRA 58B. There are two Precipitation Zones (PZs). The 10-14” PZ is predominant across the MLRA in Wyoming, including portions of Sheridan, Johnson, and Natrona Counties; portions of Campbell and Converse Counties; and smaller portions of Weston and Niobrara Counties. The 15-17” PZ occurs in northern and eastern portions of the MLRA, including portions of Sheridan, Campbell, and western Crook Counties, Wyoming. Wide fluctuations in precipitation may occur from year to year, and occasional periods of extended drought (longer than one year in duration) can be expected. Two-thirds of the annual precipitation occurs during the growing season from May through September. Mean Annual Air Temperature (MAAT) is 46°F. Cold air outbreaks from Canada in winter move rapidly from northwest to southeast and account for extreme minimum temperatures. Chinook winds may also occur in winter and bring rapid rises in temperature. Extreme storms may occur during the winter, but most severely affect ranch operations during late winter and spring. High-intensity afternoon thunderstorms may arise in summer. Annual wind speed averages about 5 mph, ranging from 6 mph during the winter and spring. Daytime winds generally are stronger than nighttime and occasional strong storms may bring brief periods of high winds with gusts to more than 75 mph. The average length of the freeze-free period (28°F) is 125 days from May 16 to September 19. The average frost-free period (32°F) is 101 days from June 1 to September 9, area-wide.

Growth of native cool-season plants begins in late April to early May with peak growth in mid- to late June. Native warm-season plants begin growth in late May to early June and continue into August. Regrowth of cool-season plants occurs in September in most years, depending upon moisture.

Note: The climate described here is based on historic climate station data and is averaged to provide an overview of annual precipitation, temperatures, and growing season. Future climate is beyond the scope of this document. However, research to determine the effects of elevated carbon dioxide (CO_2) and/or heating on mixed-grass prairie ecosystems, and how it may relate to future plant communities, is ongoing.

For detailed information, or to find a specific climate station, visit the Western Regional Climate Center (WRCC) website:
https://wrcc.dri.edu/summary/Climsmwy.html

Wind speed averages can be found at the WRCC home page, under the Specialty Climate tab: https://wrcc.dri.edu/

The following tables represent the 10-14 Inches PZ:

Table 3. Representative climatic features

Frost-free period (characteristic range)	92-103 days
Freeze-free period (characteristic range)	121-128 days
Precipitation total (characteristic range)	12-13 in
Frost-free period (actual range)	86-107 days
Freeze-free period (actual range)	116-129 days
Precipitation total (actual range)	11-14 in
Frost-free period (average)	98 days
Freeze-free period (average)	124 days
Precipitation total (average)	13 in

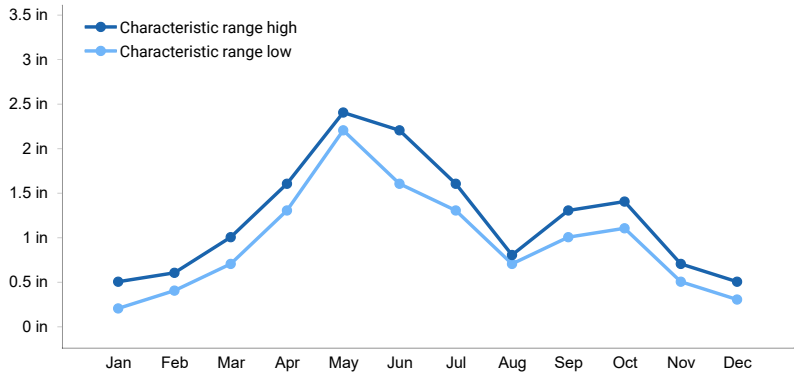

Figure 2. Monthly precipitation range

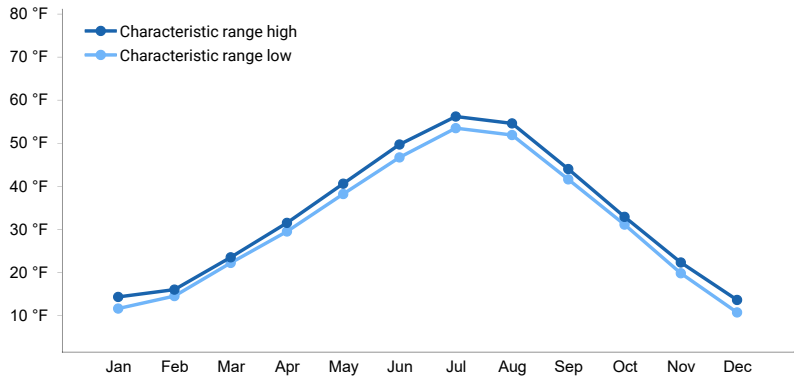

Figure 3. Monthly minimum temperature range

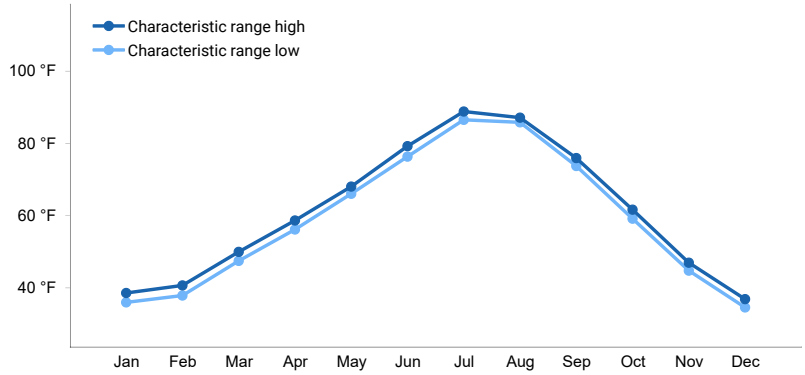

Figure 4. Monthly maximum temperature range

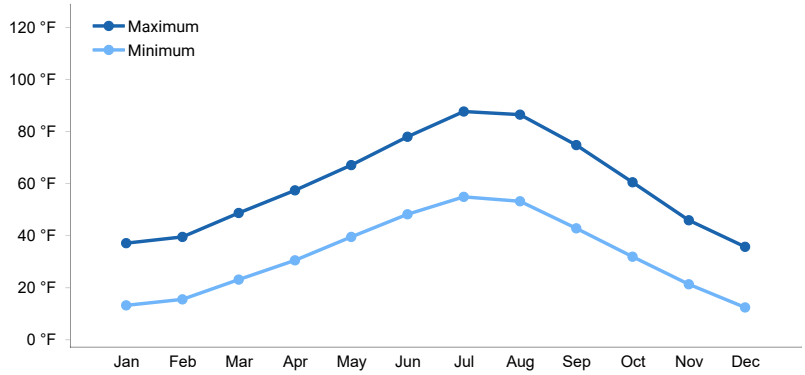

Figure 5. Monthly average minimum and maximum temperature

Climate stations used

- (1) SHERIDAN CO AP [USW00024029], Sheridan, WY
- (2) CASPER NATRONA CO AP [USW00024089], Casper, WY
- (3) DULL CTR 1SE [USC00482725], Douglas, WY
- (4) KAYCEE [USC00485055], Kaycee, WY
- (5) MIDWEST [USC00486195], Midwest, WY
- (6) WRIGHT 12W [USC00489805], Gillette, WY
- (7) GLENROCK 5 ESE [USC00483950], Glenrock, WY
- (8) WESTON 1 E [USC00489580], Weston, WY
- (9) BUFFALO [USC00481165], Buffalo, WY

Influencing water features

There are no water features of the ecological site or adjacent wetland/riparian regimes that influence the vegetation or management of the Loamy 10-14” PZ ecological site.

Soil features

The soils on this site are typically deep to very deep, but includes moderately deep, well drained soils that formed from alluvium or eolian deposits; moderately deep soils formed from residuum derived from sandstone, shale, and siltstone. They typically have a moderate to moderately rapid permeability class, but range to moderately slow in some soils. The available water capacity is moderate but may range to low in some soils. Available water is the portion of water in a soil that can be readily absorbed by plant roots. This is the amount of water released between the field capacity and the permanent wilting point. As fineness of texture increases, there is a general increase in available moisture storage from sands to loams and silt loams. The soil moisture regime is typically ustic aridic. The soil temperature regime is mesic.

The surface layer of the soils in this site are typically loam, very fine sandy loam, or fine sandy loam, but may include

clay loam and silt loam. The surface layer ranges from a depth of 1 to 7 inches thick. The subsoil is typically loam, clay loam, or sandy clay loam, but may include very fine sandy loam or silt loam. The subsoil typically contains 0 to 10 percent rock fragments in the subsoil but may range up to 35 percent in some soils. Soils in this site are typically leached of carbonates 6 to 40 inches or more; a few soils may have carbonates within 6 inches of the surface. These soils are susceptible to the hazard of erosion by water and wind. The potential for water erosion accelerates with increasing slope.

Surface soil structure is fine to medium granular, and structure below the surface is prismatic and/or subangular blocky. Soil structure describes the manner in which soil particles are aggregated and defines the nature of the system of pores and channels in a soil. Together, soil texture and structure help determine the ability of the soil to hold and conduct the water and air necessary for sustaining life.

Major soil series correlated to this ecological site include: Bidman, Cambria, Cushman, Forkwood, Kishona, Parmleed, Theedle, and Zigweid.

The attributes listed below represent 0-40 inches in depth or to the first restrictive layer.

Note: Revisions to soil surveys are on-going. For the most recent updates, visit the Web Soil Survey, the official site for soils information: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian deposits (3) Residuum–sandstone and shale (4) Residuum–siltstone
Surface texture	(1) Loam (2) Very fine sandy loam (3) Fine sandy loam
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	40–80 in
Surface fragment cover <=3"	0–5%
Available water capacity (Depth not specified)	4–8.4 in
Calcium carbonate equivalent (Depth not specified)	0–10%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (Depth not specified)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Table 5. Representative soil features (actual values)

Drainage class	Not specified

Permeability class	Moderately slow to moderately rapid
Soil depth	20–80 in
Surface fragment cover <=3"	Not specified
Available water capacity (Depth not specified)	Not specified
Calcium carbonate equivalent (Depth not specified)	Not specified
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The information in this ESD, including the state-and-transition model diagram (STM) diagram, was developed using archeological and historical data, professional experience, and scientific studies. The information is representative of a dynamic set of plant communities that represent the complex interaction of several ecological processes. The plant composition has been determined by study of rangeland relic areas, areas protected from excessive disturbance, seasonal use pastures, short duration and time-controlled grazing strategies, and historical accounts.

The Loamy 10-14” PZ ecological site is characterized by five states: Reference, Sod-bound, Native Disturbed, Invaded, and Tilled. The Reference State is characterized by cool-season rhizomatous midgrass (western wheatgrass), cool-season bunch midgrasses (needle and thread), and warm-season shortgrass (blue grama). Other grasses and grass-likes include thickspike wheatgrass, prairie Junegrass, threadleaf sedge, alkali (Sandberg) bluegrass, and bluebunch wheatgrass. A secondary component of forbs and shrubs (big sagebrush) are also present. The Sod-bound State is characterized by warm-season shortgrasses (blue grama and/or buffalograss) and grass-likes (threadleaf sedge). The Native Disturbed State is characterized by rhizomatous wheatgrasses, needle and thread, blue grama, forbs (curlycup gumweed, hairy false goldenaster, and annuals), and shrubs (fringed sagewort, snakeweed, and pricklypear). Invasives include cool-season non-native perennial grasses (bulbous bluegrass), and annuals such as cheatgrass, and field brome (also known as Japanese brome). The Invaded State is characterized by annual grasses and forbs, threeawn, prickly pear, and bare ground. The Tilled State is characterized by the “Go-back” Plant Community, which includes threeawn, annual grasses and forbs, cheatgrass and other invasive species, and bare ground.

The degree of grazing has a significant impact on the ecological dynamics of the site. This region was historically occupied by large grazing animals such as bison and elk, along with pronghorn and mule deer. Grazing by these large herbivores, along with climatic fluctuations, had a major influence on the ecological dynamics of this site. Deer and pronghorn are widely distributed throughout the MLRA. Secondary influences of herbivory by species such as small rodents, insects, and root-feeding organisms have impacted the vegetation and continue today.

Recurrent drought has historically impacted the vegetation of this region. Changes in species composition and production will vary depending upon the duration and severity of the drought cycle and on prior grazing management.

This site developed with occasional fire as part of the ecological processes. Historic fire frequency (pre-industrial), was randomly distributed and started by lightning at various times throughout the growing season. It is thought that early human inhabitants also were likely to start fires for various reasons (deliberate or accidental). It is believed that fires

were set as a management tool for attracting herds of large migratory herbivores (Stewart, 2002). The impact of fire over the past 100 years has been relatively insignificant due to the human control of wildfires and the lack of acceptance of prescribed fire as a management tool.

As this site begins to shift from a combination of frequent and severe grazing during the growing season, bunchgrasses such as needle and thread will decrease in both frequency and production. Grasses such as blue grama, threadleaf sedge, and sixweeks fescue will increase. Forbs and shrubs such as hairy false goldenaster, tansyaster, fringed sagewort, and broom snakeweed will also increase. If continued, the plant community will become sod-bound, and all midgrasses may eventually be removed from the plant community. Over the long-term, this continuous use, in combination with high stock densities, will result in bare ground developing, and invading species such as pricklypear, broom snakeweed, and annual forbs such as wooly plantain, field cottonrose, and alyssum, increasing or invading.

The following state-and-transition diagram illustrates the common plant communities that can occur on the site and the community pathways (CP) among plant communities. Plant Communities are identified by 1.1, 1.2 etc., and are described in the narrative. Bold lines surrounding each state represent ecological thresholds. Transitions (T) indicate the transition across an ecological threshold to another state. Once a threshold has been crossed into another state, it may not be feasible to return to the original state, even with significant management inputs and practices. The ecological processes plant communities, community pathways, and transition and restoration pathways will be discussed in more detail in the plant community descriptions following the diagram.

State and transition model

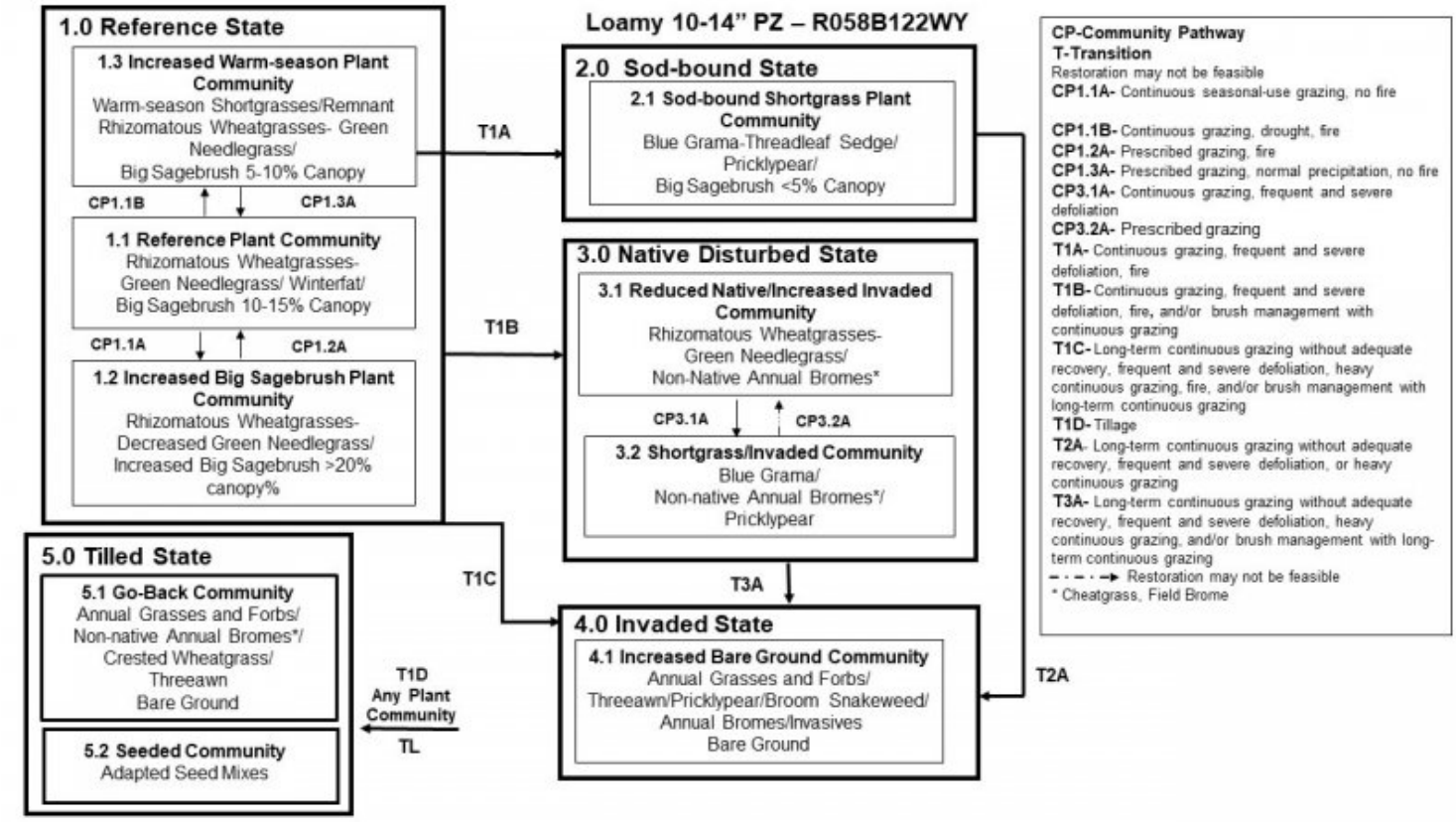

Figure 6.

State 1
Reference State

The Reference State is characterized by three distinct plant community phases: Reference, Increased Big Sagebrush, and Increased Warm-Season Plant Communities. The plant communities, and various successional stages between them, represent the natural range of variability within the Reference State.

Community 1.1
Reference Plant Community– Rhizomatous Wheatgrasses, Needle and Thread, Big Sagebrush 10-15 Percent Canopy

Figure 7. Loamy 10-14" PZ, Campbell County, WY.

The Reference Plant Community is the interpretive plant community for an ecological site. It is well adapted to the Northern Great Plains climate. This community developed with grazing by large herbivores and is suited to grazing by domestic livestock. Historically, fires were likely patchy and randomly distributed. This plant community can be found on areas where grazed plants receive adequate periods of recovery during the growing season. The potential vegetation is about 75 percent grasses and grass-likes, 5-15 percent forbs, and 5-10 percent woody plants.

The Reference Plant Community consists predominately of cool-season midgrasses, with a smaller component of warm-season shortgrasses. The major grasses and grass-likes include western wheatgrass and needle and thread. Secondary grasses include thickspike wheatgrass, prairie Junegrass, threadleaf sedge, alkali (Sandberg) bluegrass, green needlegrass, bluebunch wheatgrass, and blue grama. A variety of forbs include American vetch, white- and purple prairie clover, large Indian breadroot (also known as breadroot scurfpea), and prairie coneflower. Primary shrubs are winterfat and big sagebrush (see the Species Composition List for additional information.) Plant diversity is high.

In the 10 to 14” Precipitation Zone (PZ), the total annual production (air-dry weight) is about 1,200 pounds per acre during an average year, but it can range from about 700 pounds per acre in unfavorable years to about 1,500 pounds per acre in above-average years. Defoliation levels should be determined as part of a grazing management plan based on objectives.

Nutrient and water cycles, and energy flow are functioning properly. Infiltration rates are moderate, and soil erosion is low. Litter is properly distributed where vegetative cover is continuous. Decadence and natural plant mortality are low. This community is resistant to many disturbances except excessive grazing, tillage, or development into urban or other uses.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	530	960	1190
Shrub/Vine	115	150	180
Forb	55	90	130
Total	**700**	**1200**	**1500**

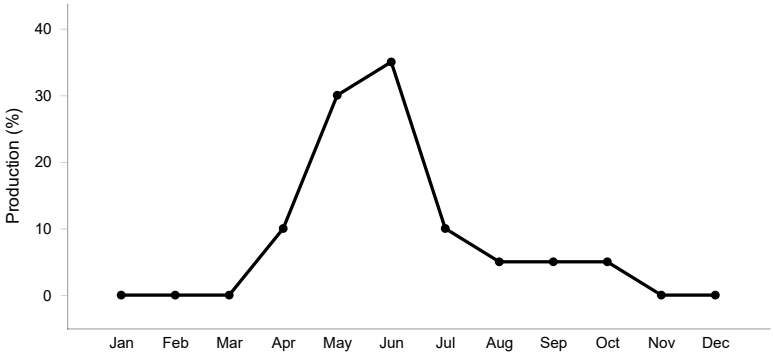

Figure 9. Plant community growth curve (percent production by month). WY1401, 10-14NP upland sites.

Community 1.2
1.2 Increased Big Sagebrush Plant Community– Rhizomatous Wheatgrasses, Decreased Needle and Thread, Increased Big Sagebrush Greater Than 20 Percent Canopy

This plant community developed with excessive grazing without adequate recovery opportunity during the growing season. Needle and thread may initially increase or decrease, depending upon the season of grazing use. Palatable forbs such as white and purple prairieclover, American vetch, and penstemon are present in reduced amounts. Hairy false goldenaster, large Indian breadroot, scarlet globemallow, fringed sagewort, and broom snakeweed have increased. Big sagebrush canopy has also increased. Natural disturbances such as lack of fire can contribute to this shift.

In the 10 to 14“ PZ, the total annual production (air-dry weight) is about 900 pounds per acre during an average year, but it can range from about 700 pounds per acre in unfavorable years to about 1,200 pounds per acre in above-average years.

Total aboveground biomass has been reduced. Reduction of cool-season bunchgrasses, nitrogen-fixing forbs, and increased warm-season shortgrasses have begun to alter the biotic integrity of this community. Water and nutrient cycles may be impaired.

Nearly all plant species typically found in the Reference Plant Community are present and will respond to changes in grazing management.

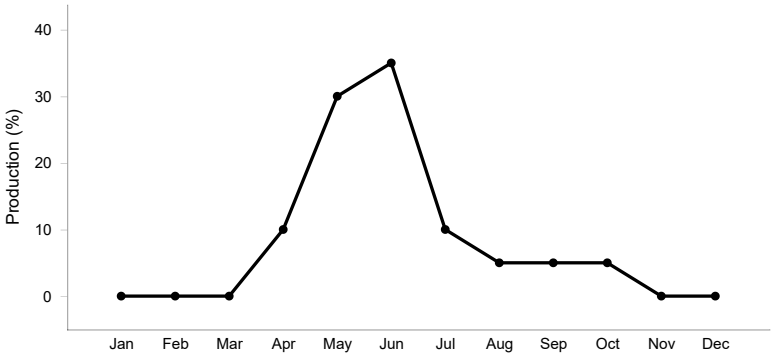

Figure 10. Plant community growth curve (percent production by month). WY1401, 10-14NP upland sites.

Community 1.3
1.3 Increased Warm-Season Plant Community– Decreased Cool-season Midgrasses, Increased Warm-season Shortgrasses, Big Sagebrush 5-10 Percent Canopy

This plant community developed with excessive grazing without adequate recovery opportunity during the growing season. Grazing-tolerant species such as blue grama and threadleaf sedge have noticeably increased. Needle and thread may initially increase or decrease depending on the season of grazing use. Palatable forbs such as white- and purple prairieclover, American vetch, and penstemon are present in reduced amounts. Hairy false goldenaster, large Indian breadroot, scarlet globemallow, fringed sagewort, and broom snakeweed have increased. Big sagebrush canopy may be reduced by fire. Natural disturbances such as fire and drought can contribute to this shift.

In the 10 to 14“ PZ, the total annual production (air-dry weight) is about 800 pounds per acre during an average year, but it can range from about 600 pounds per acre in unfavorable years to about 1,100 pounds per acre in above-average years.

Total aboveground biomass has been reduced. Reduction of rhizomatous wheatgrasses, nitrogen-fixing forbs, and increased warm-season shortgrasses have begun to alter the biotic integrity of this community. Water and nutrient cycles may be impaired.

Nearly all plant species typically found in the Reference Plant Community are present and will respond to changes in grazing management.

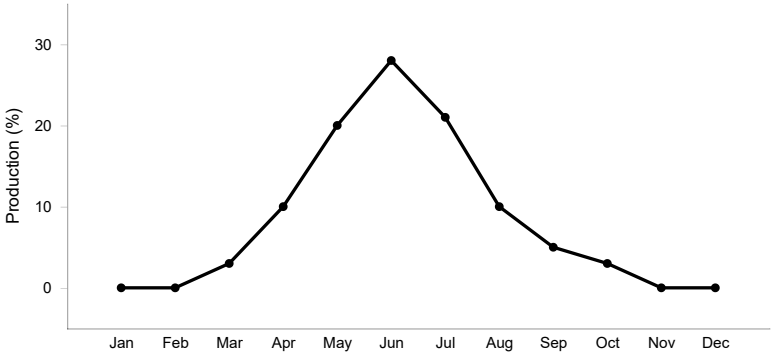

Figure 11. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

Pathway CP1.1A
Community 1.1 to 1.2

Excessive grazing without adequate recovery between grazing events, or lack of fire can shift this plant community toward the Increased Big Sagebrush Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase. Continuous seasonal-use grazing, from year-to-year (i.e. spring grazing only) will result in a loss of cool-season species. Conversely, summer use only, will result in a reduction of warm-season species. Biotic integrity and water and nutrient cycles may become impaired because of this community pathway.

Pathway CP1.1B
Community 1.1 to 1.3

Excessive grazing without adequate recovery between grazing events, drought, or fire can shift this plant community toward the Increased Warm-season Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase. Excessive grazing from year-to-year will result in a reduction or loss of cool-season species. Biotic integrity and the water and nutrient cycles may become impaired because of this community pathway.

Pathway CP1.2A
Community 1.2 to 1.1

Grazing that allows for adequate recovery between grazing events, along with proper stocking rates, will shift the Increased Big Sagebrush Plant Community back toward the Reference Plant Community. Natural disturbances such as return to normal precipitation patterns or fire will contribute to this shift.

Management actions may include the reduction of big sagebrush to appropriate levels of canopy cover together with prescribed grazing and proper stocking. Brush management by chemical treatment of big sagebrush is an option. Precaution and care should be taken when using this treatment method. The residual ecosystem properties, such as seed source, species composition, and nutrient and hydrologic cycles, greatly influence the rate and probability of successful restoration. NOTE: Brush management alone will not restore this site and is only supplemental to prescribed grazing for this restoration pathway. Recommendations include a consultation and field evaluation prior to undertaking restoration activities. This restoration activity requires more field investigation and documentation.

Conservation practices

Brush Management
Prescribed Grazing

Pathway CP1.3A
Community 1.3 to 1.1

Grazing that allows for adequate recovery between grazing events, and proper stocking rates, will shift the Increased Warm-Season Plant Community back toward the Reference Plant Community. Natural disturbances such as return to normal precipitation patterns or no fire will contribute to this shift.

State 2
Sod-bound State

This state is characterized by the Sod-bound Plant Community. An ecological threshold has been crossed and a significant amount of production and diversity has been lost when compared to the Reference State. Significant biotic and soil changes have negatively impacted energy flow and the nutrient and hydrologic cycles.

The Sod-bound State is very stable, resistant to change due to the high tolerance of blue grama and buffalograss to grazing, the development of a shallow root system or "root pan", and subsequent changes in hydrology and nutrient cycling. The loss of other functional/structural groups such as cool-season bunch and rhizomatous grasses, forbs, and shrubs, reduces the biodiversity and productivity of this site.

Community 2.1
2.1 Sod-bound Shortgrass Plant Community—Blue Grama, Threadleaf Sedge, Pricklypear, Big Sagebrush Greater Than 5 Percent Canopy

Figure 12. Sod-bound Plant Community in 10-14" PZ, Campbell County, WY

The Sod-bound Plant Community develops under long-term frequent and severe defoliation. This typically occurs when the community has been continuously grazed with heavy stocking rates, throughout the growing season over a period of many years. The midgrasses and palatable forbs have been eliminated. The dominant species are blue grama, threadleaf sedge, and/or buffalograss. These species have developed into a sod-bound condition occurring in localized colonies that exhibit a mosaic appearance. Perennial threeawn species such as Fendler's threeawn have increased. Forbs such as scarlet globemallow, wild onion, death camas, slimflower scurfpea, and skeletonplant remain. Forbs and shrubs that continue to increase are Cuman ragweed (western ragweed), hairy false goldenaster, fringed sagewort, and pricklypear. Plant diversity is very low.

Energy flow and the water and mineral cycles have been negatively affected. Litter levels are very low and unevenly distributed.

In the 10 to 14" PZ, the total annual production (air-dry weight) is about 600 pounds per acre during an average year, but it can range from about 450 pounds per acre in unfavorable years to about 750 pounds per acre in above average years.

The Sod-bound Plant Community is extremely resistant to change. Many plant species are missing a seed source that is not readily available.

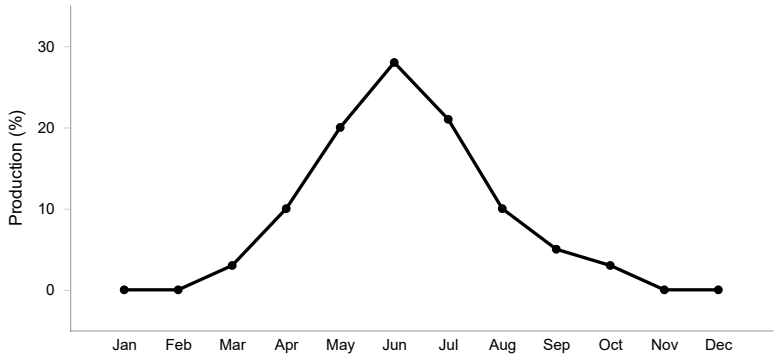

Figure 13. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

State 3
Native Disturbed State

The Native Disturbed State develops with heavy, excessive grazing or excessive defoliation, and/or brush management followed by excessive grazing. An ecological threshold has been crossed. Erosion and loss of organic matter and carbon reserves are resource concerns.

Community 3.1
Reduced Native/Increased Invaded Plant Community– Rhizomatous Wheatgrasses, Needle and Thread, Non-native Cool-Season Grasses, Blue Grama, Pricklypear

This plant community developed with frequent and severe defoliation without adequate recovery periods during the growing season, fire, or brush management followed by excessive grazing. Grazing-tolerant species such as blue grama and threadleaf sedge have noticeably increased. Needle and thread may initially increase or decrease depending upon the season of grazing use. The increased bare ground allows for the invasion of non-native perennial grasses such as bulbous bluegrass, and annual grasses such as cheatgrass or Ventenata grass.

In the 10 to 14“ PZ, the total annual production (air-dry weight) is about 600 pounds per acre during an average year, but it can range from about 450 pounds per acre in unfavorable years to about 750 pounds per acre in above-average years.

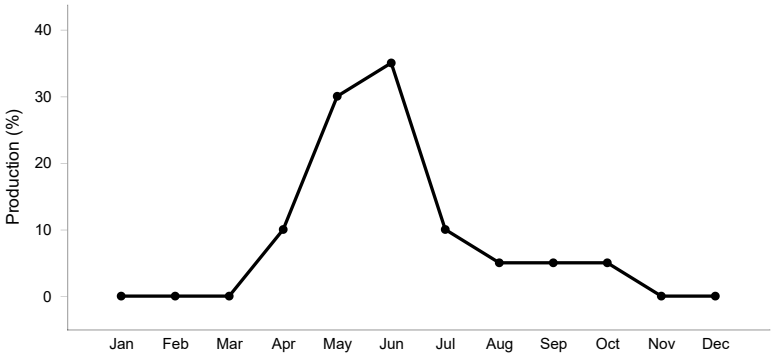

Figure 14. Plant community growth curve (percent production by month). WY1401, 10-14NP upland sites.

Community 3.2
Shortgrass/Invaded Plant Community– Blue Grama, Remnant Wheatgrasses, Non-native Annual Grasses, Pricklypear

The Shortgrass/Invaded Plant Community develops under long-term excessive grazing or frequent and severe defoliation without adequate recovery. The midgrasses and palatable forbs have been eliminated. Grazing-tolerant species such as blue grama and threadleaf sedge are prevalent. The increased bare ground allows for an increase in sixweeks fescue, and the invasion of annual grasses such as cheatgrass. Forbs and shrubs that continue to increase are Cuman ragweed (western ragweed), hairy false goldenaster, fringed sagewort, and pricklypear. Plant diversity is very low.

In the 10 to 14“ PZ, the total annual production (air-dry weight) is about 500 pounds per acre during an average year, but it can range from about 375 pounds per acre in unfavorable years to about 625 pounds per acre in above-average years.

Energy flow and the water and mineral cycles have been negatively affected. Litter levels are very low and unevenly distributed.

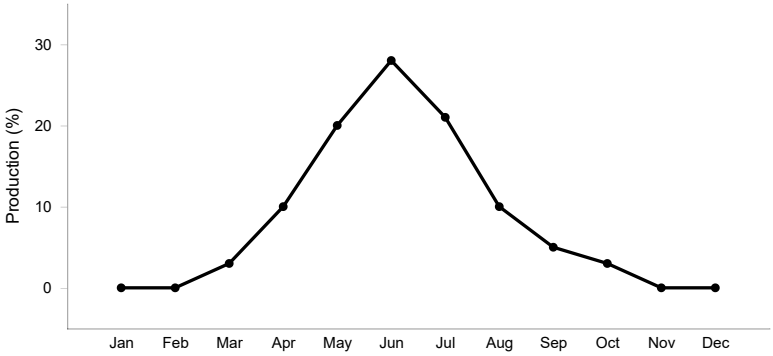

Figure 15. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

Pathway CP3.1A
Community 3.1 to 3.2

Excessive grazing or frequent and severe defoliation, without adequate recovery between grazing events can shift this plant community toward the Shortgrass/Invaded Plant Community. Over a period of years, plant species less tolerant to frequent and severe defoliation will begin to decrease, and those more tolerant will begin to increase. Bare ground will continue to increase, allowing for the invasion of non-native species. Biotic integrity and the water and nutrient cycles may become impaired because of this community pathway.

Pathway CP3.2A
Community 3.2 to 3.1

Grazing that allows for adequate recovery between grazing events, and proper stocking rates, will shift the Shortgrass/Invaded Plant Community back toward the Reduced Native/Increased Invaded Plant Community. Restoration may not be feasible, depending upon the amount of remnant wheatgrasses in the stand or the amount of non-native perennial and annual species that have moved into the site.

State 4
Invaded State

The Invaded State develops with long-term excessive grazing or frequent and severe defoliation, without adequate recovery between grazing events, heavy, excessive grazing with overstocking, or brush management followed by long-term excessive grazing will cause a shift across an ecological threshold to the Invaded State.

An ecological threshold has been crossed. Erosion and loss of organic matter and carbon reserves are resource concerns.

Community 4.1
Increased Bare Ground Community–Annual Grasses and Forbs, Threeawn, Pricklypear, Invasives, and Bare Ground

The Increased Bare Ground Plant Community occurs where the rangeland is grazed year-round, at high stock densities. Physical impact such as trampling, soil compaction, and trailing, typically contribute to this transition. The plant composition is made of annuals with a few species of perennial forbs and grasses that are very tolerant to frequent and severe defoliation. Grasses include Fendler’s threeawn. Annuals such as sixweeks fescue, Russian thistle, and kochia have increased or invaded. The dominant forbs include hairy false goldenaster, curlycup gumweed, field cottonrose, woolly plantain, and alyssum species. Green sagewort, broom snakeweed, and pricklypear are increasing.

In the 10 to 14“ PZ, the total annual production (air-dry weight) is about 500 pounds per acre during an average year,

but it can range from about 375 pounds per acre in unfavorable years to about 625 pounds per acre in above average years.

The hazard of soil erosion has increased due to the increase of bare ground. Runoff is typically high and infiltration is low. All ecological functions are impaired. Desertification is advanced.

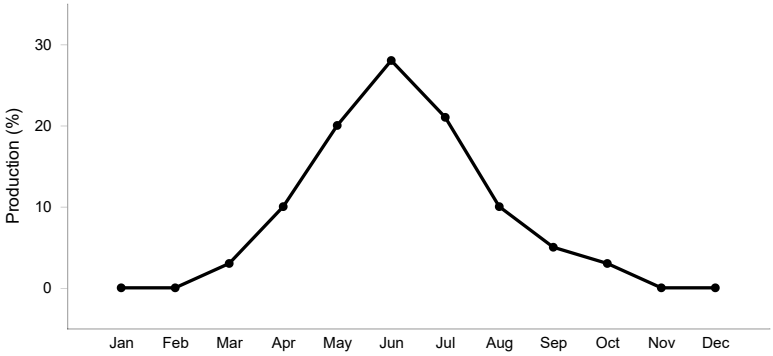

Figure 16. Plant community growth curve (percent production by month). WY5803, Northern Rolling High Plains, Southern Part, cool-season/warm-season co-dominant. Cool-season/warm-season co-dominant.

State 5
Tilled State

The Tilled State is the result of mechanical farming operations on the site. An ecological threshold has been crossed due to complete removal of vegetation and years of soil tillage. Physical, chemical, and biological soil properties have been dramatically altered. There is no restorative pathway known at this time. This state includes Go-back and Seeded Communities.

Community 5.1
Go-Back Community—Annual Grasses and Forbs, Crested Wheatgrass, Cheatgrass and Other Invasives, Threeawn, Bare Ground

Go-back land is created when the soil is tilled or farmed (sodbusted) and abandoned. All the native plants are destroyed, soil organic matter is reduced, soil structure is changed, and a plowpan or compacted layer is formed. Residual synthetic chemicals often remain from past farming operations, and erosion processes may be active.

Go-back land evolves through several plant communities beginning with an early annual plant community, which initiates the revegetation process. Plants such as Russian thistle, kochia, and other annuals begin to establish. Annual bromes such as cheatgrass and field brome (also known as Japanese brome) invade. These plants give some protection from erosion and start to build minor levels of soil organic matter. This early annual plant community lasts for two to several years. Purple threeawn, sand dropseed, and several other early perennials can dominate the plant community for five to eight years or more. Non-native cool-season grasses such as crested wheatgrass may invade, if a seed source is available. Buffalograss establishes next and dominates for many years. Eventually western wheatgrass, blue grama, and other natives become reestablished. Where go-back land has eroded to parent material, the slow process of soil development and reestablishment of vegetation will start. This is a very slow process (100 years or more). A new ecological site may evolve, depending upon the severity of soil and parent material erosion and parent material.

Community 5.2
Seeded Community— Adapted Seed Mixes

The Seeded Plant Community can vary considerably depending upon the degree of soil erosion, the species seeded, stand establishment, and the age and management of the stand. The Loamy Ecological Site has been converted to cropland in some areas.

This plant community is represented by applying the conservation practice of Rangeland Seeding on go-back land or recently cropped land for converting it to permanent vegetative cover. Plant species indigenous to the site are used throughout the MLRA due to their suitability to the semi-arid climate. Indigenous species are most adapted to site conditions and therefore can be sustained in the MLRA. Improved cultivars (named varieties) of plant species are typically used to enhance seedling establishment and meet specific reclamation resource objectives.

Transition T1A
State 1 to 2

Excessive grazing without adequate recovery between grazing events or frequent and severe defoliation, if continued, will shift this plant community across an ecological threshold toward the Sod-bound State. Biotic integrity and hydrologic function will be impaired because of this transition.

Transition T1B
State 1 to 3

Excessive grazing or frequent and severe defoliation, without adequate recovery periods following each grazing event, or brush management followed by excessive grazing will shift this plant community across an ecological threshold toward the Native Disturbed State. Erosion and loss of organic matter and carbon reserves are concerns. Non-native cool-season grasses such as bulbous bluegrass, and annual invasive species such as ventenata, and non-native annual bromes begin to invade in this transition.

Transition T1C
State 1 to 4

Long-term excessive grazing or frequent and severe defoliation without adequate recovery between grazing events, heavy, excessive grazing with overstocking, and/or brush management followed by long-term excessive grazing will cause a shift across an ecological threshold to the Invaded State.

Transition T1D
State 1 to 5

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T2A
State 2 to 4

Long-term excessive grazing or frequent and severe defoliation without adequate recovery between grazing events, or heavy, excessive grazing with overstocking, will cause a shift across an ecological threshold to the Invaded State.

Transition T2B
State 2 to 5

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T3A
State 3 to 4

Long-term excessive grazing or frequent and severe defoliation without adequate recovery between grazing events, or heavy, excessive grazing with overstocking, or brush management followed by long-term continuous grazing will cause a shift across an ecological threshold to the Invaded State.

Transition T3B
State 3 to 5

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Transition T4A
State 4 to 5

Mechanical tillage of this ecological site will cause an immediate transition across an ecological threshold to the Tilled State. This transition can occur from any plant community and is irreversible.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				175–375	
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	175–375	–
	western wheatgrass	PASM	*Pascopyrum smithii*	175–375	–
2				105–225	
	green needlegrass	NAVI4	*Nassella viridula*	105–225	–
3				175–375	
	needle and thread	HECO26	*Hesperostipa comata*	175–375	–
4				70–150	
	Cusick's bluegrass	POCU3	*Poa cusickii*	70–150	–
5				105–225	
	blue grama	BOGR2	*Bouteloua gracilis*	105–225	–
6				175–375	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	35–75	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	35–75	–
	needleleaf sedge	CADU6	*Carex duriuscula*	35–75	–
	threadleaf sedge	CAFI	*Carex filifolia*	35–75	–
	plains reedgrass	CAMO	*Calamagrostis montanensis*	35–75	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	35–75	–
	Sandberg bluegrass	POSE	*Poa secunda*	35–75	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	35–75	–
	Grass, perennial	2GP	*Grass, perennial*	35–75	–
Forb					
7				105–225	
	Forb, perennial	2FP	*Forb, perennial*	35–75	–
	yarrow	ACHIL	*Achillea*	35–75	–
	textile onion	ALTE	*Allium textile*	35–75	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	35–75	–

	aster	ASTER	*Aster*	35–75	–
	milkvetch	ASTRA	*Astragalus*	35–75	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	35–75	–
	white prairie clover	DACA7	*Dalea candida*	35–75	–
	purple prairie clover	DAPU5	*Dalea purpurea*	35–75	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	35–75	–
	scarlet beeblossom	GACO5	*Gaura coccinea*	35–75	–
	desertparsley	LOMAT	*Lomatium*	35–75	–
	bluebells	MERTE	*Mertensia*	35–75	–
	large Indian breadroot	PEES	*Pediomelum esculentum*	35–75	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	35–75	–
	American vetch	VIAM	*Vicia americana*	35–75	–
Shrub/Vine					
8				70–150	
	big sagebrush	ARTR2	*Artemisia tridentata*	70–150	–
9				35–75	
	winterfat	KRLA2	*Krascheninnikovia lanata*	35–75	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	35–75	–
Undefined					
10				24–48	

Animal community

Wildlife Interpretations (from 2001 ESD, will be revised in future updates)

Rhizomatous Wheatgrasses, Needle and Thread, Blue Grama Plant Community (HCPC): The predominance of grasses in this plant community favors grazers and mixed-feeders, such as bison, elk, and antelope. Suitable thermal and escape cover for deer may be limited due to the low quantities of woody plants. However, topographical variations could provide some escape cover. When found adjacent to sagebrush dominated states, this plant community may provide brood- rearing and foraging areas for sage grouse, as well as lek sites. Other birds that would frequent this plant community include western meadowlarks, horned larks, and golden eagles. Many grassland-obligate small mammals would occur here.

Mixed Sagebrush/Grass Plant Community: The combination of an overstory of sagebrush and an understory of grasses and forbs provide a very diverse plant community for wildlife. The crowns of sagebrush tend to break up hard crusted snow on winter ranges, so mule deer and antelope may use this state for foraging and cover year-round, as would cottontail and jack rabbits. It provides important winter, nesting, brood-rearing, and foraging habitat for sage grouse. Brewer’s sparrows’ nest in big sagebrush plants and hosts of other nesting birds utilize stands in the 20-30 percent cover range.

Heavy Sagebrush Plant Community: This plant community can provide important winter foraging for elk, mule deer and antelope, as sagebrush can approach 15 percent protein and 40-60 percent digestibility during that time. This community provides excellent escape and thermal cover for large ungulates, as well as nesting and brood-rearing habitat for sage grouse.

Western Wheatgrass/Cheatgrass Plant Community: This plant community may be useful for the same large grazers that would use the Historic Climax Plant Community. However, the plant community composition is less diverse, and thus, less apt to meet the seasonal needs of these animals. It may provide some foraging opportunities for sage grouse

when it occurs proximal to woody cover. Good grasshopper habitat equals good foraging for birds.

Blue Grama Sod and Go-back Land Plant Communities: These communities provide limited foraging for antelope and other grazers. They may be used as a foraging site by sage grouse if proximal to woody cover and if the Historic Climax Plant Community or the Western Wheatgrass/Cheatgrass Plant Community is limiting. Generally, these are not target plant communities for wildlife habitat management.

Blue Grama, Plains Pricklypear, Bare Ground Plant Community: Benefits to other wildlife are largely due to the subterranean structure created by the prairie dogs, not the sparse vegetation found on this plant community.

Animal Community – Grazing Interpretations (updated in 2019 Provisional revision)

The following table is a guide to stocking rates for the plant communities described in the Loamy 10-14" PZ site. These are conservative estimates for initial planning. On-site conditions will vary, and stocking rates should be adjusted based on range inventories, animal kind and class, forage availability (adjusted for slope and distance to water), and the type of grazing system (number of pastures, planned moves, etc.), all of which is determined in the conservation planning process.

The following stocking rates are based on the total annual forage production in a normal year multiplied by 25 percent harvest efficiency of preferred and desirable forage species, divided by 912 pounds of ingested air-dry vegetation for an animal unit per month (Natl. Range and Pasture Handbook, 1997). An animal unit month is defined as the amount of forage required by one livestock animal, with or without one calf, for one month, and is shortened to AUM.

Plant Community (PC) Production (total lbs./acre in a normal year) and Stocking Rate (AUM/acre) are listed below:

Example: Reference PC – (1,200) (0.33)

1,200 lbs. per acre X 25% Harvest Efficiency = 300 lbs. forage demand for one month. 300 lbs. per acre/912 demand per AUM =0.33

Plant Community (PC) Production (lbs.ac), and Stocking Rate (AUM/Acre)

10-14 Inch PZ:

Reference PC - (1200) (0.33)
Increased Big Sagebrush PC - (900) (0.25)
Increased Warm-season PC (800) (0.22)
Sod-Bound PC - (600) (0.16)
Reduced Native/Increased Invaded PC (*) (*)
Shortgrass/Invaded PC (*) (*)
Increased Bare Ground PC (*) (*)

*Highly variable; stocking rates must be determined on-site.

Grazing by domestic livestock is one of the major income-producing industries in the area. Rangelands in this area provide year-long forage under prescribed grazing for cattle, sheep, horses, and other herbivores. During the dormant period, livestock may need supplementation based on reliable forage analysis.

Hydrological functions

(Hydrology section from 2001 ESD, will be revised in future updates)
Water is the principal factor limiting forage production on this site. This site is dominated by soils in hydrologic groups B and C, with localized areas in hydrologic group D. Infiltration ranges from moderately slow to moderate. Runoff potential

for this site varies from low to moderate depending on soil hydrologic group and ground cover. In many cases, areas with greater than 75 percent ground cover have the greatest potential for high infiltration and lower runoff. An example of an exception would be where short-grasses form a strong sod and dominate the site. Areas where ground cover is less than 50 percent have the greatest potential to have reduced infiltration and higher runoff (refer to Part 630, NRCS National Engineering Handbook for detailed hydrology information).

Rills and gullies should not typically be present. Water flow patterns should be barely distinguishable if at all present. Pedestals are only slightly present in association with bunchgrasses. Litter typically falls in place, and signs of movement is not common. Chemical and physical crusts are rare to non-existent. Cryptogamic crusts are present, but only cover 1-2 percent of the soil surface.

Recreational uses

This site provides hunting opportunities for upland game species. The wide variety of plants which bloom from spring until fall have an esthetic value that appeals to visitors.

Wood products

No appreciable wood products are present on the site.

Other products

None noted.

Other information

Site Development & Testing Plan

General Data (MLRA and Revision Notes, Hierarchical Classification, Ecological Site Concept, Physiographic, Climate, and Water Features, and Soils Data):

Updated. All “Required” items complete to Provisional level.

Community Phase Data (Ecological Dynamics, STM, Transition & Recovery Pathways, Reference Plant Community, Species Composition List, Annual Production Table, and Growth Curve):

Updated. All “Required” items complete to Provisional level.

Annual Production Table is from the “Previously Approved” ESD (2001).

The Annual Production Table and Species Composition List will be reviewed for future updates at Approved level.

Each Alternative State/Community:

Complete to Provisional level.

Supporting Information (Site Interpretations, Assoc. & Similar Sites, Inventory Data References, Agency/State Correlation, References):

Updated. All “Required” items complete to Provisional level.

Wildlife Interpretations: Narrative is from “Previously Approved” ESD (2001). Wildlife species have to be updated at the next Approved level.

Livestock Interpretations: Plant community names and stocking rates updated.

Hydrology, Recreational Uses, Wood Products, and Other Products carried over from previously “Approved” ESD (2001).

Existing NRI Inventory Data References updated.

Reference Sheet
Rangeland Health Reference Sheet carried over from previously “Approved” ESD (2005).
It will be updated at the next “Approved” level.

“Future work, as described in a project plan, to validate the information in this provisional ecological site description is needed. This will include field activities to collect low and medium intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.” (NI 430_306 ESI and ESD, April 2015)

Inventory data references

Information presented here has been derived from data collection on private and federal lands using:
• Double Sampling*
• Rangeland Health**
• Soil Stability**
• Line Point Intercept : Foliar canopy, basal cover (Forb, Graminoid, Shrub, Subshrub, Lichen, Moss, Rock fragments, bare ground, % Litter)***
• Soil pedon descriptions collected on site****
*NRCS 528-Prescribed Grazing Standard job sheets.
**Interpreting Indicators of Rangeland Health, Version 4, 2005
***Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, Volume II, 2005
****Field Book for Describing and Sampling Soils, Version 3, 2012
NRI- Natural Resource Inventory data
Additional reconnaissance data collection using numerous ocular estimates and other inventory data; NRCS clipping data for USDA program support; Field observations from experienced range trained personnel.
Data Source: NRI
Number of Records: 181
Sample Period: 2004-2017
State: WY
Counties: Campbell, Converse, Johnson, Natrona, Niobrara, Sheridan, Weston

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Data collection for this ecological site was done in conjunction with the progressive soil surveys within the 58B Northern Rolling High Plains (Southern Part), of Wyoming and Montana.
Note: Revisions to soil surveys are on-going. For the most recent updates, visit the Web Soil Survey, the official site for soils information: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	04/01/2005
Approved by	E. Bainter
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills should not be present.

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2. **Presence of water flow patterns:** Barely observable.

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3. **Number and height of erosional pedestals or terracettes:** Essentially non-existent.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 20-30% occurring in small areas throughout the site.

5. **Number of gullies and erosion associated with gullies:** Active gullies should not be present.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Little to no plant litter movement. Plant litter remains in place and is not moved by erosional forces.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Plant cover and litter is at 70% or greater of soil surface and maintains soil surface integrity. Soil Stability class is anticipated to be 5 or greater.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Use Soil Series description for depth and color of A-horizon.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass canopy and basal cover should reduce raindrop impact and slow overland flow providing increased time for infiltration to occur. Healthy deep-rooted native grasses enhance infiltration and reduce runoff. Infiltration is Moderate.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** No compaction layer or soil surface crusting should be present.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Cool Season Bunchgrasses Cool Season Rhizomatous grasses Short-stature grasses/grasslikes Forbs = Shrubs

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Very Low.

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14. **Average percent litter cover (%) and depth (in):** Average litter cover is 25-35% with depths of 0.25 to 1.0 inches.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1200 lbs./ac

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Blue grama, Threadleaf sedge, Fringed sagewort, Prickly Pear, Big sagebrush, Broom Snakeweed,
and Species found on Noxious Weed List

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17. **Perennial plant reproductive capability:** All species are capable of reproducing.
